吉林大学学报(工学版) 2008 38 (05): 1105-1109 ISSN: 1671-5497 CN: 22-1341/T

仿生耦合功能表面应力-应变本构关系

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收稿日期 2007-8-20 修回日期 网络版发布日期 2008-8-20 接受日期

摘要
采用试验优化设计方法对相同试验条件下凹坑形仿生光滑试样以及具有仿生耦合表面的非光滑试样进行了干摩擦磨损试验对比研究。在相同试验条件下，凹坑形仿生非光滑试样磨损率小于光滑试样，即前者耐磨性较高。在此基础上，作者进行了受压状态下试样表面应力的试验测试和ANSYS有限元计算分析，探讨了非光滑凹坑对试样表面应力 应变分布的影响。结果表明：在受力状态下，仿生非光滑凹坑改善了试样表面的应力分布，使非光滑试样表面凹坑间的区域局部应力明显小于光滑试样表面的应力，即产生了局部低应力区。本文初步提出了非光滑结构的力矩效应和应力缓释效应。

关键词 工程仿生学,耦合,非光滑,试验优化设计,有限元计算,凹坑,应力

分类号 TB17

Stress strain constitutive relationship for bionic coupling functional surface

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Abstract The comparative experiments on the abrasion under unlubricated friction condition between the samples with smooth and coupling non smooth surfaces were performed by help of the experimental optimum design.It was found that the wear rate of the samples with the concave non smooth surface is less than those with the smooth surface under the other same experimental conditions,i.e.the wearing resistance of the former is better than the latter.In order to discuss the effect of the non smooth concave on the stress strain distributions on the sample surface,the sample stresses in the samples were measured at the compression condition,and analyzed by the finite element method using the software ANSYS.The results show that the concave structure ameliorates the surface stress distribution of the non smooth sample,makes the local stress between concaves less apparently than that of the smooth sample,that means the local low stress areas are formed on the non smooth surface.Moreover,the torque effect and low stress release effect of the non smooth structure were proposed preliminarily.

Key words engineering bionics coupling non smoothness experimental optimum design finite element analysis concave stress

DOI:

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